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Real-Time White-Board

Akshay Sharma[1] | Shallu Bashambu[2]

[1]B. Tech Scholar, Department of IT, Maharaja Agrasen Institute of Technology, Delhi, India
[2]Assistant Professor, Department of IT, Maharaja Agrasen Institute of Technology, Delhi, India

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ABSTRACT

Human connection is more important than ever as the world battles COVID-19. The internet plays an important role in connecting people throughout the world. Many businesses have taken certain measures to connect and collaborate in these unwanted times. This has led to an increase in demand for online collaboration tools for connecting people throughout the world. A tool widely used in such places to collaborate and connect is a whiteboard. In this paper, we develop a tool to increase collaboration without restricting people to any location, any particular OS, or any particular device needed to be used. Our application allows users to interact and collaborate through visual explanations, especially regarding the writing of the text, making diagrams, uploading images and models/sketches interactively that can be shared with all participants connected over the network in real-time. The tool does not require any plug-in to be downloaded, it is easy to use and has no limit on the number of clients. We have implemented this system by using HTML5 Canvas, Node.js, and Socket.io.

KEYWORDS: *white-board, virtual white-board, real-time, socket.io*

I. INTRODUCTION

Information and Communication Technology (ICT) has an important role in business communication, online collaboration & distance education.ICT solutions have proven to be instrumental in helping to improve the quality of education and learning services. One of the most popular ICT solutions to date is online learning or electronic learning (e-learning)[1].

Meetings and classrooms demand the presence of the person in the room if he wants to participate. A tool widely used in such places is a whiteboard [3]. A virtual whiteboard is a shared whiteboard application where multiple clients can connect and write, share, and interact with each other in real-time without needing to be in the same physical location. The virtual whiteboard has become a key piece of technology in remote teams to help with tasks such as brainstorming, problem-solving, and writing creative briefs [8]. The real-time whiteboard has a wide range of use cases. It can be used to collaborate in online meetings by sharing thoughts using diagrams or to prepare a meeting agenda or take notes. It can be useful in conducting digital workshops they come in handy when the presenter wants to clarify their ideas more. It can also act as a way of making presentations different and much more interactive. It can also be very useful for teaching purposes especially in the case of distant and online modes of teaching.

To make this whiteboard we will be using the technologies HTML5 canvas, Node.js, Socket.io, and JavaScript to construct the Real-time whiteboard. The tool will be machine-independent, OS independent and multiple users without any limit can join over a network. Node.js, which is event-driven, will create a fast and light server.

Socket.io will create a persistent connection between client and server, enabling real-time communication between them [3].

II. RELATED WORK

A. Prasetya, Didik discussed in their paper the different limitations of e-learning such as a visual representation of diagrams and their explanations. To resolve these limitations they proposed a tool that connects students and teachers to a shared whiteboard. They have further discussed how their paper will help in distance learning and online collaborations.

B. Mâta, L., Lazar, G., & Lazăr, I. in their research paper have discussed the impact of interactive whiteboards used in teaching and learning Science. They have researched the impact of interactive whiteboards in Learning Sciences and their findings reveal there are positive effects of the use of Interactive Whiteboards in learning and teaching Sciences. Pardanjac, Marjana & Karuovic, Dijana & Eleven, Erika in their paper has also discussed the possibilities of the use of interactive whiteboards and the use of this software in the teaching process.

C. Ringe, Swati & Kedia, Rishabh & Poddar, Anuj & Patel, Sahil. discussed in their paper how HTML based whiteboard can be used in meeting collaborations and e-learning. They have used HTML5, Node.js & Websockets to build their application. They have evaluated the performance of their application using New relic API and the statistics showcase a low response time. As the response time is low, users can see an instant change of data, and hence a high level of real-time communication is attained.

D. Nikos Pinikas, Spyros Panagiotakis, Despina Athanasaki, Athanasios G. Malamos discussed in their paper how high-quality real-time applications can be developed by the use of WebRtc APIs. They have demonstrated certain use cases of WebRtc APIs in online collaboration such as screen recording, screen streaming, and sharing.

III. TECHNOLOGIES USED

A. HTML5 Canvas: It is a HTML element used to draw graphics in HTML using JavaScript. We have used canvas for making our whiteboard and its various functionalities such as to draw, erase or write a text on screen.

B. Node.js : It is a platform built on Chrome's JavaScript runtime for easily building fast and scalable network applications. Node.js uses an event-driven, non-blocking I/O model that makes it lightweight and efficient, perfect for data-intensive real-time applications that run across distributed devices.

C. Socket.io: It is a JavaScript library for real-time data communication. It enables real time, bi-directional communication between web clients and servers. It has two parts: a client-side library that runs in the browser, and a server-side library for Node.js. Socket.io uses Web-Sockets API for real-time communication and as web-sockets use TCP connections they are faster and reliable.

D. New Relic: New Relic is a web application performance service designed to work in real-time with live web apps. New Relic Infrastructure provides flexible, dynamic server monitoring. This is used to evaluate performance of applications.

IV. DESIGN AND IMPLEMENTATION

The application starts with the user creating a room or joining an existing room. There is no limit on the number of connected clients. Every user will have access to a whiteboard where they can make changes which will be visible to other connected clients in that room. These changes include drawing with a pencil, or writing a text on the board, or uploading any image on the board. The room also consists of a chat window to communicate within the room. Every change is updated in real-time for the connected users in the room.

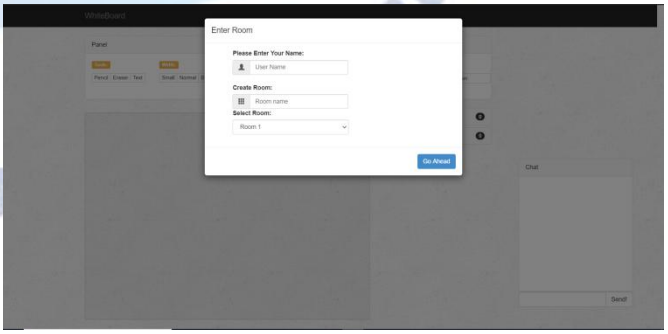

Fig 1.0 Room creation

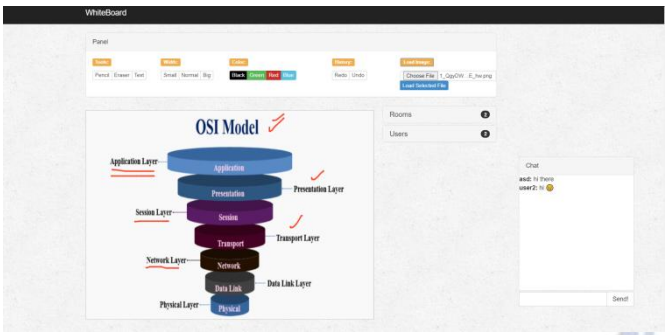

Fig 2.0 User uploading an image

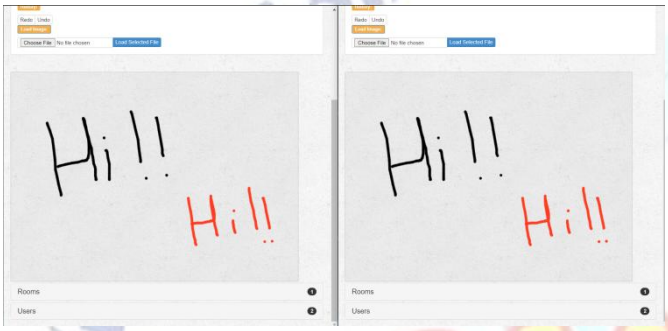

Fig 3.0 Two windows of two users connected in a room

For making real-time changes there were two options available either to use socket.io or WebRTC. As socket.io has more support hence we have used socket.io instead of WebRTC. Socket.io uses web-socket protocols for a real-time update. In Web-sockets a TCP connection is created between client and server. This allows a bidirectional flow of data between client and server. In TCP connection after initial handshake, sockets can communicate with much less overhead. These statistics of less overhead surely adds up more speed in the client-server communication process.

The system contains two sides a client-side and a server-side. Requests are made on the client-side (such as to draw a line) and the server-side listen to that request. Whenever a request is received on the server-side that request is broadcasted to every other client connected over the network. The client then listens to that request and makes changes on the client-side. This way changes made by one client can be seen by other clients as well. This is done using socket.io. As socket.io uses web-sockets changes made by users are updated in real-time with less delay.

V. RESULT

With the help of this tool, we were able to make connections over a network. Users were able to create a room or join an existing room. Changes made by users were reflected in real-time. The performance of the application is evaluated using New Relic monitoring API. The server is running on a local machine with Windows 10, i5 CPU, and 8GB RAM.

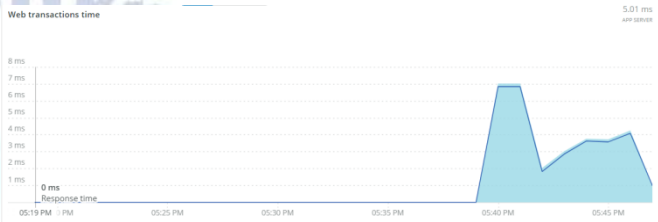

Fig 4.0 Graph showing change in response time

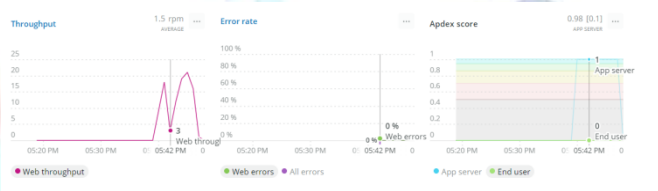

Fig 5.0 Graphs showing throughput & error statistics

These are the statistics of the application when 5 users were connected over the network and were continuously sending server requests. As RPM (requests per minute) increases response time also tends to increase.

VI. CONCLUSION

Real-time whiteboard applications can be implemented in electronic learning, virtual interviews, team collaborations, etc. The design of this application will be able to help collaborate through visual explanations, especially regarding the writing of the text, drawing diagrams, sketches, and models interactively that can be shared with all participants connected over the network. Real-time data updating can be done using socket.io or WebRtc. In this project, we have made use of socket.io as it has global support.

The future scope of this application includes creating a virtual interview assessment portal with features such as video sharing & shared text editor to facilitate online interview scenarios. Also, some features such as sticky notes, graph plotting, etc.

could be added to make e-learning much more fun and interactive.

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